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ABSTRACT

A system of classifying research unviersities is proposed based on quantitative criteria. Data from several studies were used to develop a list of 57 leading U.S. research universities. The Carnegie Commission's 1973 and 1976 classification of "Research Universities I" and the Academy for Educational Development's listing are presented, along with research university lists developed by the Association of Research Libraries. Additional lists include: the leading universities in terms of total financial support for research for 1983; and the leading research universities based on total research and development expenditures, Ph.D. production, faculty size, and size of research libraries. These lists, which rank universities on the basis of standards, were subjected to a four-step elimination process, which begins with the 100 leading universities that received the largest support for scientific research in 1983. From this list, schools were eliminated that did not produce at least 100 Ph.D.s in 1983, and schools that employed fewer than 1,000 full-time scientists and engineers as faculty members. Further selection was based on having an outstanding research library. (SW)

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A PROPOSED SYSTEM FOR CLASSIFYING RESEARCH UNIVERSITIES

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HE 020 478

A Proposed System for Classifying Research Universities

There have been numerous attempts to rank or to classify universities in the past several years. Most of these might be called "reputational" ranking attempts, while a few have used quantifiable criteria upon which to base their conclusions.

Some attempted a combination of both, but these have, for the most part, been rankings of the reputation/productivity of departments or areas within the university, rather than of the university as a whole.

My intent here is to suggest a system of classification of research universities (with emphasis on science) based on quantitative criteria selected because of the generally accepted idea that research universities should meet certain common standards. Each has an outstanding library or libraries, has a "critical mass" of faculty members, is of sufficient size and scope to award a considerable number of doctorates in the sciences and engineering, and is able to attract a significant amount of research support from all sources--state, federal, and private.

Previous studies have treated these standards separately to rank universities. I shall use the rankings from those studies to provide a broader foundation for classification.

First, a look at why a new system of classification is important. It is perhaps axiomatic that it takes an institution at least a generation to build a reputation--or to change one. We all know of departments within universities that were considered great 20 years ago which now have lost many of their most distinguished faculty members, their output of publications in prestigious journals, and their attraction for graduate students and postdoctoral fellows, and yet they are still frequently listed among the "top 10" in surveys of practitioners in the field. Some of these respondents no doubt still tend to think of those departments in terms of their "glory days." So it is with universities.

The reverse is equally true. Some institutions which did not even exist 30 years ago may now be classified as research universities, and others, which 30 years ago may have been known as strong undergraduate colleges, have now reached the status of "great" research universities.

One frequently sees lists of the "top 10" departments (or schools or colleges of this and that) based entirely upon a mail survey of faculty members, department heads, and/or deans in institutions across the nation. Many of these simply ask the

recipient of the form or letter to "rank," in order, the "top 10" programs nationally, without definition, without criteria, and without further guidance. Pride, loyalty--call it what you may--will prompt the dean of the School of Law at Universal University to list his alma mater first (or second), then Harvard, Yale or Stanford, et cetera.

If the survey researcher has included in his form a list of quantitative criteria for the consideration of his respondents, his published list of the "top 10" law schools might have been quite different.

At least two studies in the past 10 years have attempted not to rank, but to classify universities on the basis of such criteria. In 1973, The Carnegie Commission on Higher Education published A Classification of Institutions of Higher Education as one of its technical reports.(1) The report "sought to identify categories of colleges and universities that would be relatively homogenous with respect to the functions of the institutions as well as with respect to characteristics of students and faculty members."

The report identified "Doctoral-Granting Institutions," which were further classified as "Research Universities I," and "Doctoral-Granting Universities II."

Its other classifications included "Comprehensive Universities and Colleges, I and II," and "Professional Schools and Other Specified Institutions," with several classifications, by fields of study, within that category.

The category, "Research Universities I," in the 1973 Carnegie Commission report included "the 50 leading universities in terms of federal financial support of academic science in at least two of three academic years, 1968-69, 1969-70, and 1970-71, provided they awarded at least 50 Ph.D.'s (plus M.D.'s if a medical school was on the same campus) in 1969-70." The report states that "Rockefeller University was included because of the high quality of its research and doctoral training, although it did not meet criteria."

Thus, the Carnegie Commission chose to base its list of "50 Research Universities I," on a combination of two quantitative criteria--a minimum of "50 Ph.D.'s" (or "M.D.'s") awarded in a given year (1969-70) and outside support of research from federal sources in at least two of the three academic years between 1968 and 1971. (Actually there are 52 "Research Universities I" listed in the report, 30 public institutions and 22 private).

The Carnegie Commission report was updated in 1976, using the same quantifiable criteria--doctorates awarded and federal financial support--but for the years 1972-75 rather than 1968-72.(2)

In the 1976 report three institutions (two public and one private) were added, and four (three public and one private) were dropped. Thus, as shown in Table I, the 1976 report lists 51 "Research Universities I."

Note the shifting of ranks; two public universities which attained "Research University I" ranking in 1976 were listed in 1973 as "Research Universities II," while the private institution that "moved up" was not listed as a research university at all in 1973. The four that were "dropped" were all listed in 1976 as "Research Universities, II."

Another report based on similar criteria appeared in 1973, that of the Academy for Educational Development, as shown in Table II.(3) The report, entitled "The Campus Resources of Higher Education in the United States of America," listed 59 "leading research universities." As in the Carnegie study, there was no attempt to "rank" the institutions. The 59 were selected on the basis of Ph.D.'s granted and federal funds for research in the previous year.

Both the Carnegie reports and the report of the academy chose to combine two criteria: research support and Ph.D. production. This combination had a "levelling" effect--eliminating those institutions which for one reason or another are in good position to receive very large amounts of federal funding but which are not true graduate institutions in the production of a reasonable number of Ph.D.'s.

For purposes of this study we have used 1983 data. Table III shows the leading 100 universities in terms of total financial support for research for 1983. Table IV lists the institutions in Table III which produced 100 or more Ph.D.'s in 1983.

A third quantifiable criterion was introduced in a study conducted by the Subcommittee on Budget, Management, and Expenditures of the United States Committee on Governmental Operations (a committee of the Congress).(4) The report of this study, published in 1973, developed a ranking of all colleges and universities in the United States, based on the numbers of faculty members from each institution serving on federal "peer" committees and panels.

This resulted in a ranking of institutions based, at least to some extent, on the quality of faculty members as seen by their peers at other institutions and within the staffs of the

several federal agencies. This is the only study reported in the literature which might be considered an effort to focus on the quality of the total faculty of institutions--a criterion extremely difficult to measure. If it is used as such a measure, it must be recognized that an element of "reputation" must be present. It seems unlikely that all of the faculty members selected to serve on such panels and committees are representative of the best in their fields. Some must have been selected through the "old boy network," and some because of the reputation of the department or institution in which they teach.

However, since it is the only such study extant, it seems important to mention it here, and to express the hope that the Congress will see fit to update the study in the near future. It is after all, considered a mark of prestige to be invited to sit on peer committees of the National Science Foundation, the National Institutes of Health, and other such agencies.

If a "critical mass" of faculty members is to be considered a valid criterion for inclusion in lists of research universities, then the annual report of the National Science Foundation, a "headcount" of scientists and engineers on the faculties of the nation's universities, has value.(5) A research university needs a large faculty. Faculty members "have to have somebody to talk to," as we all know. More important, a large faculty provides an informal system of checks and balances in the research effort. Table V eliminates those institutions shown in Table IV which had fewer than 1,000 full-time science and engineering faculty members.

Last, and very significant, is a criterion which almost everyone can agree upon--the importance of the library or libraries in the evaluation of a research university. Fortunately, the Association of Research Libraries provides an annual ranking of its member institutions.(6) The Association ranks its member institutions in 15 variables, based on quantitative data, and then provides an "index" ranking--a kind of all-inclusive summary. Such data as number of volumes, serial subscriptions, funding, and size of library staff are included.

The most recent ARL Index is for 1983-84. Table VI lists all of the institutions (excluding Canadian universities) in the ARL Index for 1983-84.

TABLE I

The Carnegie Commission's "Research Universities I"(7)

1973 Public Universities	1976 Public Universities
University of Arizona	University of Arizona
University of California-Berkeley	University of California-Berkeley
University of California-Davis	University of California-Davis
University of California-L.A.	University of California-L.A.
University of California-San Diego	University of California-San Diego
University of Colorado	Colorado State University
University of Florida	University of Colorado
University of Georgia	University of Florida
University of Hawaii	University of Georgia
University of Illinois	University of Hawaii
Purdue University	University of Illinois
University of Iowa	Purdue University
University of Kentucky	University of Iowa
University of Maryland	University of Maryland
Michigan State University	Michigan State University
University of Minnesota	University of Minnesota
University of Missouri	University of Missouri
Rutgers University	North Carolina State University
North Carolina State University	University of North Carolina
University of North Carolina	Ohio State University
Ohio State University	Oregon State University
Pennsylvania State University	Pennsylvania State University
University of Pittsburgh	University of Pittsburgh
University of Tennessee	Texas A&M University
Texas A&M University	University of Texas
University of Utah	University of Utah
University of Washington	University of Washington
University of Wisconsin	University of Wisconsin

TABLE I (Continued)

1973 Private Universities	1976 Private Universities
Calif. Institute of Technology	Calif. Institute of Technology
University of Southern California	University of Southern California
Stanford University	Stanford University
Yale University	Yale University
University of Miami	University of Miami
Northwestern University	Northwestern University
University of Chicago	University of Chicago
Johns Hopkins University	Johns Hopkins University
Harvard University	Boston University
Massachusetts Inst. of Technology	Harvard University
Washington University	Massachusetts Inst. of Technology
Princeton University	Washington University
Columbia University	Princeton University
Cornell University	Columbia University
New York University	Cornell University
Rockefeller University	New York University
University of Rochester	Rockefeller University
Yeshiva University	University of Rochester
Duke University	Yeshiva University
Case Western Reserve University	Duke University
University of Pennsylvania	Case Western Reserve University
Vanderbilt University	University of Pennsylvania

TABLE II

The "Leading Research Universities--The Academy For Educational Development, 1973"(8)

Boston University	University of California-San Diego
California Inst. of Technology	University of Chicago
Case Western Reserve University	University of Colorado
Colorado State University	University of Florida
Columbia University	University of Georgia
Cornell University	University of Hawaii at Manoa
Duke University	University of Illinois at Urbana
Harvard University	University of Iowa
Johns Hopkins University	University of Kansas
Massachusetts Inst. of Technology	University of Kentucky
Michigan State University	University of Maryland
New York University	University of Miami
North Carolina State Univ.-Raleigh	University of Michigan
Northwestern University	University of Minnesota
Ohio State University	University of Missouri
Oregon State University	University of North Carolina
Pennsylvania State University	University of Pennsylvania
Princeton University	University of Pittsburgh
Purdue University	University of Rochester
Rutgers University	University of Southern California
Stanford University	University of Tennessee
State University of New York	University of Texas
Temple University	University of Utah
Texas A&M University	University of Virginia
Tulane University of Louisiana	University of Washington
University of Arizona	University of Wisconsin
University of California-Berkeley	Vanderbilt University
University of California-Davis	Washington University
University of California-L.A.	Yale University
	Yeshiva University

The two Carnegie Commission on Higher Education reports were based on important quantitative measures of research university excellence: the number of doctoral degrees granted and the amount of federal support for scientific research. Quantitative data on doctoral degrees granted is considered to be an important measure of the stature of a university.

Why the Commission chose to limit its research support criteria to federal support is baffling. Much research support in today's research universities comes from the states--especially in the case of public universities--and from private sources such as endowments, foundation grants, and grants and contracts from business and industry, in all universities.

The National Science Foundation reports data on total financing of "research and development" expenditures at universities and colleges each year as well as federally financed R&D expenditures. The report of total R&D seems much more meaningful, especially considering that for a number of years medical schools and engineering schools have been heavily supported with federal funds, while federal support for basic science in certain other fields has barely kept pace with inflation. In some such cases, states, foundations, and private business and industry have stepped in and made up the size of the deficit.

Some states are more supportive of research in their public institutions than are others. These state dollars are just as important to the research effort as are the federal dollars. Private dollars, whether from philanthropic sources or from business and industry, are important to the program of the research university.

I believe that a list of leading research universities can be developed by taking the lists that rank universities on the basis of common standards mentioned earlier and subjecting them to a process of elimination. The following is the procedure that I have applied to arrive at a list of the leading research universities in the United States:

1. Begin with the 100 leading doctorate-granting universities in terms of total support for scientific research in 1983. See Table III.

2. Subtract from the list all those institutions which did not produce at least 100 Ph.D.'s in 1983. See Table IV.

3. Subtract from the remaining list all those institutions which employed fewer than 1,000 full-time scientists

and engineers as faculty members in 1983. See Table V.

4. Choose the leading research universities from the remaining institutions which rank highest in the ARL Index. See Table VI.

From this procedure emerge 57 universities which lead in the areas noted earlier as common standards that research universities must meet:

-- Total financial support for scientific research.
-- Production of Ph.D.'s in science and engineering.
-- Critical mass of 1,000 or more scientists and engineers on the faculty.
-- An outstanding research library.

Unfortunately, this eliminates certain prestigious smaller universities, most of which are always included in purely reputational listings, recognized for their superior programs and distinguished faculty members. In many cases these do not have the "critical mass" of science faculty members for which this classification procedure calls, nor do they graduate large numbers of Ph.D.'s in the sciences.

Subjecting available data (the four studies discussed) to the four-step elimination procedure delineated, I have developed a list of the 57 leading research universities in the United States. The use of four disparate criteria precludes an accurate ranking; therefore, I have listed them in alphabetical order in Table VII.

The list shown on Table VII, is admittedly biased in favor of institutions with strong research programs in the sciences, and in favor of the larger universities.

This list includes 41 public and 17 private universities, a disparity which may reflect the rapidly increasing costs of graduate education and research, and increased recognition and support by the public sector for graduate education and research.

Although the final list is a composite one, and therefore presented in alphabetical order rather than by rank, the "top 50" institutions in each of the four categories upon which that list was based are shown in rank order in Table II and Tables VIII-X. In Table X, the ARL library index scores are only a summary description of library size based on quantitative measures. The scores are in no way a qualitative measurement of the collections, services, or operations of the libraries.

TABLE III

R&D Expenditures (in thousands) at Doctorate-Granting Institutions for Fiscal Year 1983(10)

	Institutional Ranking		Total
1.	Johns Hopkins University	(Estimated)	303,115
2.	Massachusetts Institute of Technology		200,349
3.	University of Wisconsin-Madison		168,282
4.	Stanford University		163,031
5.	University of Minnesota		156,189
6.	Cornell University		153,323
7.	University of California-San Diego		147,008
8.	University of Washington		133,523
9.	University of Michigan		132,864
10.	University of California-Berkeley		118,951
11.	Harvard University		118,602
12.	Columbia University-Main Division		113,847
13.	University of Pennsylvania		113,499
14.	University of California-Los Angeles		113,266
15.	University of Texas-Austin		110,570
16.	Texas A&M University		103,219
17.	Yale University		100,269
18.	University of Illinois-Urbana		99,135
19.	University of California-Davis		98,118
20.	Pennsylvania State University		89,767
21.	University of California-San Francisco		89,247
22.	University of Arizona		89,192
23.	University of Southern California		84,395
24.	Georgia Institute of Technology		82,924
25.	Michigan State University		79,043
26.	University of Colorado		75,798
27.	Purdue University		75,510
28.	University of Chicago		75,314
29.	Ohio State University		74,146
30.	University of Florida		73,467
31.	University of Georgia		70,665
32.	Washington University		69,357
33.	New York University		68,554
34.	Louisiana State University		68,383
35.	University of Rochester		65,305

TABLE III (Continued)

Institutional Ranking		Total
36.	Iowa State University	64,861
37.	Oregon State University	62,723
38.	North Carolina State University-Raleigh	59,909
39.	University of Connecticut	58,902
40.	Duke University	55,040
41.	Baylor College of Medicine	54,986
42.	University of Iowa	54,771
43.	Yeshiva University	53,812
44.	Rockefeller University	52,000
45.	Northwestern University	51,075
46.	University of North Carolina-Chapel Hill	50,892
47.	SUNY at Buffalo	50,129
48.	California Institute of Technology	49,824
49.	Rutgers University	49,729
50.	University of Miami	48,283
51.	University of Pittsburgh	47,313
52.	University of Utah	46,830
53.	University of Hawaii-Manoa	45,401
54.	University of Nebraska-Lincoln	44,597
55.	University of Texas System Cancer Ctr.	44,509
56.	University of Illinois-Chicago	44,497
57.	Indiana University	44,331
58.	University of Missouri-Columbia	44,231
59.	Carnegie Mellon University	43,174
60.	Case Western Reserve University	42,691
61.	Oklahoma State University	42,503
62.	Woods Hole Oceanographic Institute	42,070
63.	New Mexico State University	41,579
64.	Colorado State University	41,572
65.	University of Oklahoma	40,987
66.	University of Kentucky	40,829
67.	Virginia Polytechnic Institute	40,420
68.	University of Maryland-College Park	38,674
69.	University of Virginia	37,620
70.	University of Alaska-Fairbanks	37,325
71.	University of California-Riverside	37,236
72.	Princeton University	37,017
73.	SUNY at Stony Brook	36,941

TABLE III (Continued)

	Institutional Ranking	Total
74.	Utah State University	36,711
75.	University of Texas Health Science Center-Dallas	36,456
76.	Mississippi State University	35,714
77.	Kansas State University	35,310
78.	Washington State University	33,583
79.	University of New Mexico	33,356
80.	University of California-Irvine	33,293
81.	Boston University	32,421
82.	University of Alabama-Birmingham	31,311
83.	University of Massachusetts-Amherst	29,696
84.	University of Cincinnati	29,008
85.	CUNY Mt. Sinai School of Medicine	28,561
86.	Vanderbilt University	26,322
87.	Virginia Commonwealth University	26,235
88.	Auburn University	26,176
89.	University of Rhode Island	24,766
90.	University of Texas Health Science Center-San Antonio	24,743
91.	Temple University	24,632
92.	Emory University	24,284
93.	Wayne State University	23,990
94.	Rensselaer Polytechnic Institute	23,084
95.	University of California-Santa Barbara	22,884
96.	Brown University	22,805
97.	Florida State University	22,767
98.	Tulane University	22,440
99.	Arizona State University	22,294
100.	University of Kansas	22,111

TABLE IV

The Leading Research Universities in Total R&D Expenditures
Which Had 100 or More Ph.D. Graduates in Academic Science in 1983
(Listed Alphabetically)

Arizona State University	University of Massachusetts, Amherst
University of Arizona	Michigan State University
Boston University	University of Michigan
Brown University	University of Minnesota
Case Western Reserve University	University of Missouri-Columbia
Colorado State University	University of Nebraska-Lincoln
Columbia University-Main Division	University of New Mexico
California Institute of Technology	New York University
University of Calif.-Berkeley	North Carolina State University-Raleigh
University of Calif.-Davis	University of North Carolina
University of Calif.-Los Angeles	Northwestern University
University of Calif.-Santa Barbara	Ohio State University
University of Calif.-San Diego	Oklahoma State University
University of Calif.-Riverside	University of Oklahoma
University of Southern California	Oregon State University
University of Chicago	Pennsylvania State University
University of Cincinnati	University of Pennsylvania
University of Colorado	University of Pittsburgh
University of Connecticut	Princeton University
Cornell University	Purdue University
Duke University	University of Rochester
Florida State University	Rutgers University
University of Florida	Stanford University
University of Georgia	SUNY at Buffalo
Harvard University	SUNY at Stony Brook
University of Hawaii-Manoa	Temple University
Johns Hopkins University	Texas A&M University
University of Illinois-Urbana	University of Texas-Austin
Indiana University	University of Utah
Iowa State University	Virginia Polytechnic Institute & SU
University of Iowa	University of Virginia
Kansas State University	University of Washington
University of Kansas	Washington University
University of Kentucky	Washington State University
Louisiana State University	Wayne State University
University of Maryl.-College Park	University of Wisconsin-Madison
Mass. Institute of Technology	Yale University

TABLE V

The Leading Research Universities in Total R&D Expenditures
Which Had 100 or More Ph.D. Graduates in Academic Science and
1,000 or More Full-Time Faculty Members in Academic Science and Engineering
(Listed Alphabetically)

University of Arizona	Michigan State University
Boston University	University of Michigan
University of Calif.-Berkeley	University of Minnesota
University of Calif.-Davis	University of Missouri-Columbia
University of Calif.-Los Angeles	New York University
University of Calif.-San Diego	N. C. State University-Raleigh
University of Southern California	University of N. C.-Chapel Hill
Case Western Reserve University	Northwestern University
University of Chicago	Ohio State University
University of Cincinnati	University of Oklahoma
Colorado State University	Oregon State University
Columbia University-Main Div.	Pennsylvania State University
University of Connecticut	University of Pennsylvania
Cornell University	University of Pittsburgh
Duke University	Purdue University
University of Florida	University of Rochester
University of Georgia	Rutgers University
Harvard University	Stanford University
University of Hawaii-Manoa	SUNY at Stony Brook
Johns Hopkins University	Temple University
University of Illinois-Urbana	Texas A&M University
Indiana University	University of Texas-Austin
Iowa State University	University of Utah
University of Iowa	Virginia Polytechnic Institute & SU
Kansas State University	University of Virginia
University of Kansas	University of Washington
University of Kentucky	Washington University
Louisiana State University	Wayne State University
University of Maryl.-College Park	University of Wisconsin-Madison
Mass. Institute of Technology	Yale University

TABLE VI

Institutions (Excluding Canadian Universities) in the Association of Research Libraries Index, 1983-84(9)

University of Alabama
Arizona State University
University of Arizona
Boston University
Brown University
University of Calif.-Berkeley
University of Calif.-Davis
University of Calif.-Irvine
University of Calif.-Los Angeles
University of Calif.-Riverside
University of Calif.-Santa Barbara
University of Calif.-San Diego
University of Southern California
Case Western Reserve University
University of Chicago
University of Cincinnati
Colorado State University
University of Colorado
Columbia University
University of Connecticut
Cornell University
Dartmouth University
University of Delaware
Duke University
Emory University
Florida State University
University of Florida
Georgia Institute of Technology
University of Georgia
Georgetown University
Harvard University
University of Hawaii
University of Houston
Howard University
Johns Hopkins University
University of Illinois
Southern Illinois University
Indiana University
University of Iowa
Iowa State University
University of Kansas
Kent State University
University of Kentucky
Louisiana State University
University of Maryland
Mass. Institute of Technology
University of Massachusetts
Miami University
Michigan State University
University of Michigan
University of Minnesota
University of Missouri
University of Nebraska
University of New Mexico
New York University
University of North Carolina
University of South Carolina
North Carolina State University
Northwestern University
Notre Dame University
Ohio State University
Oklahoma State University
University of Oklahoma
University of Oregon
Pennsylvania State University
University of Pennsylvania
University of Pittsburgh
Princeton University
Purdue University
Rice University
University of Rochester
Rutgers University
Stanford University
SUNY at Albany
SUNY at Buffalo
SUNY at Stony Brook
Syracuse University
Temple University
University of Tennessee
Texas A&M University
University of Texas
Tulane University
University of Utah
Vanderbilt University
Virginia Polytechnic Institute & SU
University of Virginia
Washington State University
Washington University, St. Louis
University of Washington
Wayne State University
University of Wisconsin
Yale University
Brigham Young University

An examination of those tables shows that of the nine institutions which appear in the "top 20" in all four categories, eight are public universities and one is private: Harvard University, which is first in two of the lists--rank in the ARL Index and numbers of scientists and engineers on the faculty. It ranks eighth in Ph.D.'s produced, and eleventh in total support for research.

The other eight include: Cornell, in the "top 10" in all categories; Wisconsin, in the "top 10" in three categories and eleventh in the fourth (ARL Index); Minnesota, in the "top 10" in three and thirteenth in the ARL Index; Michigan, in the "top 10" in three and thirteenth in the numbers of scientists and engineers on the faculty; UCLA and Illinois, in two of the "top 10" lists; and the University of Washington, in one "top 10" list; and Pennsylvania State University.

There are four universities which appear in the "top 20" in three of the four categories: Stanford University (in the "top 10" in all but the list of full-time science and engineering faculty); Columbia University (in the "top 10" in the ARL Index); Massachusetts Institute of Technology (second in total support); and the University of Texas (sixth in the ARL Index).

The private universities make their best showing in the category of total support: seven of the "top 20" are private, 13 public. In the ARL Index there are 14 public institutions and six private, in the "top 20." Sixteen public and four private universities are in the "top 20" in numbers of full-time scientists and engineers on the faculty; and 17 public universities and three private are among the "top 20" in Ph.D. degrees awarded.

There are many factors which contribute to the inclusion of certain universities in the list of 58 which lead the nation in the production of research and doctoral graduates. We have admitted to the bias of this study toward science, and toward the larger institutions, particularly at the graduate level. Other contributing factors have to do with the structure of the nation's leading universities.

For example, a few states have separate public medical schools, and therefore total support for science in the "main" state university is less than it would be if the medical school were a part of that main university.

Engineering is a field which attracts sizeable federal and industrial support. If an institution does not include an engineering school, its total support for research may be expected to be reduced accordingly.

In some cases, the fact that excellent, large libraries are located in nearby institutions or cities may have prevented the growth of the university's library.

Other distinguished universities have made conscious decisions to give emphasis to undergraduate excellence, or to such fields as the arts, the humanities, or theology, which may not attract large amounts of outside support for research.

TABLE VII

The Leading American Research Universities in Total Support for Research, Production of Ph.D. Degrees in Science and Engineering, Size of Faculty in Academic Science, and Size of Research Libraries, 1983.

University of Arizona	Michigan State University
Boston University	University of Michigan
University of Calif.-Berkeley	University of Minnesota
University of Calif.-Davis	University of Missouri
University of Calif.-Los Angeles	New York University
University of Calif.-San Diego	North Carolina State University
University of Southern California	University of North Carolina
Case Western Reserve University	Northwestern University
University of Chicago	Ohio State University
University of Cincinnati	University of Oklahoma
Colorado State University	Pennsylvania State University
Columbia University	University of Pennsylvania
University of Connecticut	University of Pittsburgh
Cornell University	Purdue University
Duke University	University of Rochester
University of Florida	Rutgers University
University of Georgia	Stanford University
Harvard University	SUNY at Stony Brook
University of Hawaii	Temple University
Johns Hopkins University	Texas A&M University
University of Illinois	University of Texas-Austin
Indiana University	University of Utah
Iowa State University	Virginia Polytechnic Institute & SU
University of Iowa	University of Virginia
University of Kansas	University of Washington
University of Kentucky	Washington University
Louisiana State University	Wayne State University
University of Maryland	University of Wisconsin
Mass. Institute of Technology	Yale University

TABLE VIII

The 50 Leading Research Universities
Granting Ph.D.'s in 1983(11)

University of Calif.-Berkeley	University of Florida
University of Wisconsin	University of N.C.-Chapel Hill
University of Michigan	Boston University
Ohio State University	University of Georgia
University of Illinois, Urbana	Florida State University
Michigan State University	University of Calif.-Davis
University of Minnesota	Texas A&M University
Harvard University	Northwestern University
University of Calif.-Los Angeles	Yale University
Stanford University	University of Arizona
University of Southern California	University of Iowa
Mass. Institute of Technology	Virginia Polytechnic Institute & SU
Cornell University	University of Virginia
University of Texas, Austin	University of Missouri-Columbia
Indiana University	Temple University
Pennsylvania State University	Iowa State University
University of Pittsburgh	University of Kansas
University of Washington	Wayne State University
Purdue University	University of Cincinnati
University of Pennsylvania	Johns Hopkins University
University of Maryland	Duke University
University of Chicago	University of Oklahoma
New York University	Oregon State University
Rutgers University	University of Rochester
Columbia University	University of Calif.-San Diego

Source: National Research Council. "Number of Institutions Granting Ph.D. Degrees and Number of Ph.D.'s From Each Institution by Field of Doctorate." 1983.

TABLE IX

The 50 Leading Research Universities in Numbers of Full-Time Scientists and Engineers Employed in 1983(5)

Harvard University	University of Pennsylvania
Johns Hopkins University	University of Washington
University of Wisconsin	University of Calif.-Davis
University of Minnesota	Rutgers University
Louisiana State University	Duke University
Cornell University	University of Calif.-Berkeley
Ohio State University	University of Arizona
University of Florida	University of Calif.-San Francisco
Texas A&M University	University of Colorado
Mass. Institute of Technology	New York University
University of Calif.-Los Angeles	Case Western Reserve University
University of Illinois	Iowa State University
University of Michigan	University of Calif.-San Diego
Pennsylvania State University	University of Connecticut
Purdue University	University of Southern California
Columbia University	University of Kansas
University of Kentucky	University of Maryland
University of Washington	Northwestern University
University of Utah	CUNY, Mt. Sinai
Yale University	University of Missouri
Indiana University	University of North Carolina
North Carolina State University	University of Rochester
Michigan State University	University of Miami
University of Iowa	University of Georgia
University of Texas	

Source: National Science Foundation. Academic Science/Engineering: Scientists and Engineers. (January, 1984), Table B-51.

TABLE X

ARL Library Index, 1983-84, Excluding Canadian Universities, By Rank Order.

1. Harvard University
2. University of Calif.-L.A.
3. University of Calif.-Berkeley
4. Yale University
5. Stanford University
6. The University of Texas
7. The University of Illinois
8. Columbia University
9. The University of Michigan
10. Cornell University
11. The University of Wisconsin
12. The University of Washington
13. The University of Minnesota
14. Ohio State University
15. Princeton University
16. The University of North Carolina
17. The University of Indiana
18. Pennsylvania State University
19. The University of Arizona
20. The University of Chicago
21. University of Calif.-Davis
22. The University of Pennsylvania
23. The University of Virginia
24. Rutgers University
25. Howard University
26. The University of New York
27. The University of Georgia
28. Arizona State University
29. SUNY at Buffalo
30. Northwestern University
31. University of Southern Calif.
32. Michigan State University
33. Duke University
34. The University of Kansas
35. The University of Iowa
36. University of Calif.-Santa Barb.
37. The University of Florida
38. The University of Pittsburgh
39. University of Calif.-San Diego
40. The University of Houston
41. Texas A&M University
42. Johns Hopkins University
43. Louisiana State University
44. The University of Maryland
45. The University of Hawaii
46. Syracuse University
47. Mass. Institute of Technology
48. The University of Kentucky
49. Boston University
50. The University of Cincinnati
51. Georgetown University
52. Wayne State University
53. Virginia Polytechnic Institute
54. Washington University, St. Louis
55. The University of Missouri
56. The University of Connecticut
57. The University of Rochester
58. Emory University
59. Miami University
60. University of Southern Illinois
61. Washington State University
62. Purdue University
63. The University of South Carolina
64. Iowa State University
65. Brigham Young University
66. Brown University
67. SUNY at Stony Brook
68. University of Calif.-Irvine
69. Vanderbilt University
70. The University of Utah
71. The University of Colorado
72. Temple University
73. The University of Nebraska
74. Tulane University
75. North Carolina State University
76. The University of Oklahoma
77. Georgia Institute of Technology
78. SUNY at Albany
79. The University of New Mexico
80. The University of Tennessee
81. The University of Massachusetts
82. The University of Delaware
83. The University of Oregon
84. Florida State University
85. Dartmouth University
86. University of Calif.-Riverside
87. The University of Alabama
88. Colorado State University
89. The University of Notre Dame
90. Kent State University
91. Rice University
92. Oklahoma State University
93. Case Western Reserve University

Footnotes

(1) The Carnegie Commission on Higher Education. A Classification of Institutions of Higher Education. A Technical Report. McGraw-Hill, 1973.

(2) Ibid., 1976.

(3) Management Division, Academy for Educational Development, Inc., The Campus Resources of Higher Education in the United States of America. (1973, November).

(4) Federal Advisory Committees, First Annual Report of the President to the Congress, Washington: U.S. Government Printing Office, (1974, January 7), Part 5.

(5) National Science Foundation, Academic Science/Engineering: Scientists and Engineers, (1984, January), Table B-51.

(6) Stubbs, Kenneth. The ARL Library Index and Quantitative Relationships in the ARL. Washington: ARL, 1980.

(7) Carnegie Commission, op. cit.

(8) Academy for Educational Development, op. cit.

(9) Stubbs, op. cit.

(10) National Science Foundation, Academic Science/Engineering: R&D Funds, Fiscal Year 1983, (1984, January), Table B-29.

(11) National Research Council. "Number of Institutions Granting Ph.D. Degrees and Number of Ph.D.'s From Each Institution by Field of Doctorate." 1983.

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